protoplasm of animals and the material which they break down into secretions, such as the components of bile, or such as the hydrochloric and sulphuric acid of other glands. But still more important are the examples of elaboration and synthesis presented by some of the lowest organisms. Without chlorophyll, or, as far as we have any ground for conclusion, any such intermediary, the protoplasm of the Bacteria acts upon ammonium acetate so as to build up carbon, nitrogen, hydrogen, and oxygen into an albuminoid compound like itself. Such action appears to be the specialty of protoplasm, for even when a share of the work is attributed in the green plant to the green pigment chlorophyll, yet we have to come back to protoplasm to finish the job and do the really difficult feat of combining carbo-hydrates and ammonia. By dismissing chlorophyll from the operation altogether we do not add materially to the capricious many-sidedness of protoplasm. Here it can take carbon from carbonic acid and nitrogen from ammonia, there it can do with nothing less than an acetate, there again it must have a tartrate at least, and in a fourth example it perishes without albumens.

If the green pigment has been misrepresented in the foregoing indictment, and if it really is something more than a screen for protoplasm, its character must be re-established by direct demonstration of its capabilities. The facts, as at present in evidence, look very much indeed as though chlorophyll had been assigned a position of unmerited dignity.[1] E. RAY LANKESTER

HANDBOOK OF BOTANY

Handbuch der Botanik. Bearbeitet und herausgegeben von Dr. N. J. C. Müller, Professor in Münden. Erster Band, Erster Theil. Anatomie und Physiologie der Gewächse. (Heidelberg, 1880: Carl Winter's Universitätsbuchhandlung.)

THE volume before us is the first of a work which is to treat of all the departments of the science of botany. In his preface Prof. Müller explains that he has been led to undertake this very serious task by the conviction that unity of design is the first essential in an educational work such as this is to be, and that this unity cannot be attained unless all the parts of it come from the same hand. Possibly his estimate of the value of this unity may be correct, but it must not be forgotten that the division of a labour such as this secures one very important advantage, namely, the complete treatment of each of the separate parts, and this may after all be quite as important as the unity of design.

These considerations naturally recall to memory the handbook which was planned on so magnificent a scale by Hofmeister. That work is still unfinished, and long periods of time intervened between the publication of volumes of it by the different authors, so that, as it is, the work necessarily exhibits but little unity of design, and must therefore, from Prof. Müller's point of view, possess comparatively little educational merit. As a matter of fact, however, the deficient unity is hardly noticed, for the parts are so complete in themselves that they can stand alone, and are of permanent value as books of reference.

We will now proceed to form an estimate of the success which has attended Prof. Müller in the execution of the first part of his plan. In this volume he treats more especially of the physiology of plants, giving also some account of their coarser anatomy, and he does so with so much detail that he fills more than six hundred pages. It will perhaps be well to defer any remarks upon the latter subject until it has been treated, as Prof. Müller promises, in a more complete manner in subsequent volumes.

With regard to physiology, then, it must be admitted that Prof. Müller's work is an elaborate one, and that it gives evidence of much labour and thought; but yet the result cannot be regarded as other than unsatisfactory. It contains a great deal of information, some of it of a very recondite description, but it is not arranged in a clear and logical manner so that the student can readily grasp the facts and appreciate their mutual relations. There is a want of proportion or perspective about it, and the result is that the fundamental facts do not stand out clearly from those of secondary importance. The mode of stating the facts is not always all that could be desired. On p. 1, for instance, protoplasm is spoken of as being *fluid* (*flüssig*), a mode of describing its consistence which is generally considered to be inaccurate. But the most serious defect in the book is the want of definite statements of the conditions under which the more important vital phenomena take place. There is a sort of vagueness about Prof. Müller's account of these which will prove distressing to any student who reads his book. For example, let us take the discussion of the mode of growth in surface of the cell-wall. On p. 100 there is a very brief statement of the theory of growth by intussusception; on p. 146 there is an account of Nægeli's theory of the structure of the cell-wall; but when we turn to p. 170, where the account of the actual growth of the cell-wall is given, no reference is made to either of these theories, which are generally regarded as being of the first importance in explaining the process of growth. Then as to the turgid condition of the growing cell: this is certainly mentioned on p. 170 and on p. 193, but no hint is given of the means by which this condition is produced and maintained, or of its significance in the process of growth. It is evident that a student would have considerable difficulty in obtaining anything like a clear idea of the mode of growth in surface of a cell wall from Prof. Müller's account of it.

Again, there is no clear distinction made, in Prof. Müller's account of the circulation of liquids in the plant, between the slow movement of solutions of nutritious substances and the rapid movement of water in connection with the process of transpiration; and the paths along which the liquids travel in these two movements are by no means clearly traced. The recent important researches of Sachs and of von Höhnel on this subject appear to have been overlooked.

Further, in discussing the decomposition of carbonic acid by chlorophyll under the influence of sunlight, Prof. Müller makes no clear statement as to which of the

[1] Mr. Vines suggests that if Pringsheim's view be correct, then it might be possible by aid of an artificial chlorophyll screen to excite the protoplasm of fungi or even of animals to the decomposition of carbonic acid. This seems to me unlikely on account of the definitely characteristic chemical activities acquired by protoplasm in different organisms. *But it certainly would be worth while trying the experiment with an etiolated green plant and an artificial chlorophyll screen.* The experiment would be decisive.

rays of the solar spectrum are the more active in the process.

It would be easy to multiply criticisms of this kind, but enough has been already said to show that the book is unsuitable for the use of students, at least of those who are not already tolerably advanced. The first essential of a good handbook for students is that it should give a clear and, as far as possible, complete account of the actual attainments of the science of which it treats. This Prof. Müller's book certainly does not do. Many points of importance are either omitted or treated far too superficially, whereas others of less importance are discussed at great length in a highly theoretical manner, which, be it said, is often ingenious and interesting. The book cannot, therefore, be regarded as a successful handbook; its merits are rather those of a treatise upon those parts of the physiology of plants which are susceptible of a physical and mathematical treatment.

It only remains to add that the general appearance of the book, the paper, type, and figures are good, and to express the regret that there is not an alphabetical index at the end which might serve as a guide through the somewhat intricate mazes of the contents.

OUR BOOK SHELF

On the Urari, the Deadly Arrow-poison of the Macusis. By Richard Schomburgk, Ph.D. 4to. Pp. 18. (Adelaide: E. Spiller.)

IN this pamphlet the author describes the researches made by himself and by his brother, Sir Robert Schomburgk, into the modes of preparation of urari. Although an arrow-poison is prepared by a number of Indian tribes in Guiana, and between the Amazon River and the Orinoco, yet that prepared by the Macusi Indians is much stronger, and other tribes come very long distances in order to obtain it. This greater strength is thought by the author to depend upon the use by the Macusi Indians of the *Strychnos toxifera*. The bark of this plant contains all the properties of the urari, and the Macusi Indians add to it a number of other substances. With great difficulty the author prevailed upon an old urari-maker to show him the process of preparing the poison. The ingredients were—bark of *Strychnos toxifera*, 2 lbs.; from Yakki (*Strychnos schomburgkii*), ¼ lb.; Arimaru (*Strychnos cogens*), ¼ lb.; Wakarimo, ¼ lb.; the root of Tarireng, ½ oz.; the root of Tararemu, ½ oz.; the fleshy root of Muramu (*Cissus spec.*); four small pieces of wood of a tree of the species of Xanthoxyleæ, called Manuca. (Manuca is the strong bitter wood of a tree of the Xanthoxyleæ. The bark and the root are used as an effective remedy against syphilitic sickness on the Rio Negro, Amazon, and Rio Branco.)

These ingredients were crushed singly in a mortar, and the bark of *Strychnos tox.* was thrown first into a pot containing about seven quarts of water. As soon as the water began to boil he added at intervals a handful of the other ingredients except the muramu. The whole was then kept boiling very slowly, the foam being carefully skimmed away, for twenty-four hours, the mixture being kept at an equal heat. At the expiration of that time the extract had been reduced by boiling to about a quart, became thick, and assumed the colour of strong coffee. It was then strained through a large funnel made of palm-leaves and filled with fresh silk-grass. The filtrate was exposed in a flat vessel to the sun for about three hours, and he then added the slimy juice expressed from the muramu root, which had been previously soaked for a short time in the boiling poison. The urari immediately underwent a remarkable alteration, curdling to a jelly-like substance. The poison was then poured into very flat earthen vessels, in order to still further concentrate it by exposure to the sun. When it reached the consistency of thick treacle it was poured into small calabashes, where it ultimately changed into a hard substance. During the preparation a number of superstitious precautions are taken, in order, as they imagine, to prevent the poison losing its efficacy. No certain remedy is known for the effects of the poison; those employed by the Indians are the juice of sugar-cane either alone or mixed with an infusion of the leaves of the tree *Eperua falcata*. Salt and urine are sometimes also employed as remedies.

The author mentions the researches on the physiological action of urari by Waterton and Virchow, but seems unaware of, or at least does not allude to, the observations of Bernard, or the more recent works of German observers. This pamphlet is, however, interesting as containing the author's own original observations upon the mode of preparation of the urari, made, as they were, under great difficulties.

Notes of Observations on Injurious Insects. Report, 1879. (London: W. Swan Sonnenschein and Allen, 1880.)

THIS report, for the production of which we are mainly indebted to the exertions of Miss E. A. Ormerod, the Rev. T. A. Preston, and Mr. E. A. Fitch, is, this year, one of unusual interest, inasmuch as it reviews the destructive work of the insect world to our garden and field crops during a summer unequalled for its want of sunshine and continued heavy rains. Moreover, owing to the energy displayed by the editor in inducing gardeners, foresters, &c., to record what observations they may have made, we have, as the result, a very full and very varied report. Notwithstanding that the temperature was below and the rainfall above the average, "the returns show insect attack fully up to the usual amount, and insect presence often exceeding it. The unusual cold of the winter and the depth to which the frost penetrated the ground do not appear to have acted prejudicially on larvæ subjected to them, either at the time or in subsequent development, and the only cases in which the weather appears notably to have had effect in ridding us of insect attack is where the persistent rainfall or the tremendous downpour of summer storms have fairly swept the insects from the plants, or in some cases of leaf-feeders, where the plant-growth has (conjecturally) been driven on past the power of the larvæ."

Referring to the power of the frost "during the past winter" (the report is dated December 19 last), it is stated that at Dalkeith it penetrated the earth to a depth of fifteen inches, while in Perthshire it went down to from twenty to twenty-four inches. Miss Ormerod alludes to the prevalent idea that "cold kills the grubs," and gives her experience of an examination of all larvæ and pupæ found fully exposed to its influence, whether unsheltered, under bark, or in frozen ground. In every case, even where the ground was frozen so hard that it required a hammer to break it, and the larvæ and pupæ were perfectly rigid, on thawing they showed no sign of injury, "and in the case of the larvæ of the cabbage weevil (which was the only instance in which any immediate action was to be expected) they continued the operation of making their earth cases for pupation (as is usual with this grub on disturbance from the gall) as if nothing had happened."

The extreme severity of the winter was also favourable, in other respects, to insect-preservation, large numbers being secured from the attacks of birds by being buried under the snow or in the frost-bound ground.

The report, which embodies notes from observers all over the United Kingdom, is one of very great value not only